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In broad terms the invention comprises an air circulation and ventilation unit including:
a housing configured to fit at least partially over the ceiling of an equipment cabinet
including fitting over at least one vent in the ceiling of the cabinet, so that the interior of
the housing is in communication with the interior of the cabinet, the housing having a
5 housing vent including a closure moveable between an open position in which air is
permitted to flow through the housing vent between the outside of the housing and the
inside of the housing and a closed position in which little or no air is permitted to flow
through the housing vent between the outside of the housing and the inside of the
housing, and a controller to control the position of the housing vent closure.

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Preferably the air circulation and ventilation unit further includes a temperature sensor
on the inside of the cabinet attached to the controller that provides an indication of the
temperature inside the cabinet.

15 Preferably the air circulation and ventilation unit further includes a fan inside the
housing to circulate air.

Preferably the fan is controlled by the controller inside the air circulation and ventilation
unit.

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In some embodiments the air circulation and ventilation unit may include a heater inside
the housing that is controlled by the temperature sensor inside the cabinet.

25 Preferably the controller includes a solenoid that controls the position of the housing
vent closure.

Preferably the housing vent closure rotates between the open and closed positions.

30 Preferably the air circulation and ventilation unit is provided in combination with an
equipment cabinet having a ceiling, with the housing fitting over at least one vent in the
ceiling of the cabinet, so that the interior of the housing is in communication with the
interior of the cabinet.

Preferably the combination further includes a roof over the air circulation and ventilation unit.

Preferably the combination includes a fan inside the cabinet to circulate air.

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Preferably the housing vent is offset from the cabinet vent(s).

BRIEF DESCRIPTION OF DRAWINGS

- 10 The invention will be further described by way of example only and without intending to be limiting with reference to the following drawings, wherein:

Figure 1 shows a cabinet with an air circulation and ventilation unit of the invention with the vent in the open position;

- 15 Figure 2 shows a cabinet with an air circulation and ventilation unit of the invention with the vent in the closed position; and

Figure 3 shows an embodiment of the air circulation and ventilation unit of the invention.

DETAILED DESCRIPTION

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Figure 1 shows one embodiment of air circulation and ventilation unit 2 of the invention attached to a cabinet 1. Cabinet 1 has a lower vent and filter 6 and upper vents 5 and 8 (in the ceiling of the cabinet) through which air can circulate. The lower vent and filter 6 receives air through plinth vent 7. The plinth vent may form part of a separate piece that is attached to the bottom of the cabinet.

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In general cabinet 1 will be insulated to retain some heat inside the cabinet and reduce the amount of noise that escapes from the cabinet.

- 30 Air circulation and ventilation unit 2 sits between the ceiling and roof of cabinet 1. The air circulation and ventilation unit includes at least one vent 4 and controller 3. Vent 4 includes a closure 4a that can be rotated between an open position (shown in Figure 1)

and a closed position (shown in Figure 2). Controller 3 controls the position of the vent closure. The interior of air circulation and ventilation unit 2 is in communication with the interior of the cabinet through vents 5 and 8.

- 5 As can be seen in Figure 1 vent 4 in the air circulation and ventilation unit is spaced apart from vents 5 and 8 in the ceiling of the cabinet. An external roof 9 protects the air circulation and ventilation unit and inside of the cabinet from rain, dust particles and the like while still maintaining a tamper proof cabinet and allowing ventilation. Although Figures 1 and 2 show a cabinet with two ceiling vents, the number, size and position of
10 the ceiling vents in the cabinet may vary. The shape of roof 9 and the shape, number and position of the vents may also vary.

- In preferred embodiments the air circulation and ventilation unit includes at least one temperature sensor. In a preferred embodiment the temperature sensor is positioned
15 inside the cabinet. In an alternative embodiment a temperature sensor is positioned inside the air circulation and ventilation unit. The controller 3 receives an indication of when the temperature is outside a predetermined range as sensed by the temperature sensor. If the temperature falls outside the predetermined operating range the controller may operate the vent 4 to open or close the vent. For example if the internal
20 temperature of the cabinet rises above the upper limit of the temperature range the temperature sensor sends an indication to controller 3 and the controller opens vent 4 to allow air to circulate into the roof and to the outside of the cabinet as shown by arrows 13 and 14. Likewise if the temperature within the cabinet falls below the lower limit of the temperature range the temperature sensor sends an indication to the controller 3 and
25 the controller closes vent 4 to prevent air circulating within the cabinet from exiting the cabinet via the roof space. In one embodiment controller 3 is a solenoid, although any suitable controller may be used.

- In one embodiment the air circulation and ventilation unit includes a fan provided in the
30 cabinet, under a vent, for example under vent 5. In an alternative embodiment the air circulation and ventilation unit may include a fan that may be positioned underneath air

circulation and ventilation unit 2. The fan may be controlled by a temperature sensor inside the cabinet to assist in air circulation.

5 If the cabinet and air circulation and ventilation unit is housed in an area that experiences very cold temperatures the air circulation and ventilation unit may include a heater to heat the inside of the cabinet if the temperature inside the cabinet falls below a predetermined lower limit. In one embodiment the heater is controlled by a temperature sensor inside the cabinet.

10 As can be seen from the arrows in Figure 1 when vent 4 is open air circulates from the bottom of the cabinet and out through the top and under the openings in roof 9 following arrows 15, 16, 17, 13, and 14. This allows air to circulate through the cabinet through the air circulation and ventilation unit 2 and out of the cabinet. This cools equipment in the cabinet if the temperature inside the cabinet is greater than that outside
15 the cabinet.

Figure 2 shows an air circulation and ventilation unit of the invention with the vent closed. When the vent is closed air circulates within the cabinet. As can be seen in Figure 2 when vent 4 is closed little or no air can escape through vent 4 and into the
20 roof space of the cabinet. The air inside the cabinet circulated between the interior of the cabinet 1 and the interior of housing 2 through vents 5 and 8 as shown by arrows 18, 19, 20, 21, 22, and 23. Fresh air may still enter the cabinet through lower vent and filter 6.

25 Controller 3 may respond to information from temperature sensor(s) and/or to an indication of the load on the components. For example if the component load is high the amount of heat generated by the components will be greater than when the component load is low so the vent may be opened during periods of high component load. In an alternative embodiment the controller may open and close the vent based on
30 the time of day and the day of the year. This system has less flexibility to changing weather and component load conditions. Controller 3 may also respond to a condensation indication so as to reduce condensation within the cabinet. In one embodiment controller 3 is a thermostatically controlled solenoid. In an alternative

embodiment controller 3 may include a microprocessor or the like and receive temperature indications from the temperature sensor(s). The controller may then open or close vent 4 in response to temperature or other indications. In this embodiment the controller may also control any fans or heaters and these can be controlled
5 independently of the vent.

Figure 3 is a plan view of an air circulation and ventilation unit of the invention. The air circulation and ventilation unit includes housing 2, controller 10 and vent 4 and vent closure 4a. The bottom of the housing unit (not shown) is open to allow communication
10 between the inside of the air circulation and ventilation unit and the interior of the cabinet. Vent 4 provides a means of communication between the inside of the air circulation and ventilation unit (and therefore the interior of the cabinet) and the roof space of the cabinet when the vent is open. In this embodiment controller 10 is a solenoid that receives an indication from a temperature sensor (not shown) and in
15 response opens or closes vent 4. In a preferred embodiment the temperature sensor is inside the equipment cabinet. Alternatively the temperature sensor can be housed inside the housing 2. In a further alternative embodiment a temperature sensor is housed outside the cabinet and housing to provide an indication of the outside air temperature.

20 As can be seen in Figure 3 vent closure 4a rotates about an axle (not shown) through housing 2. Attached to the axis is metal strip 12 which forms a connection between the axle and the solenoid 10 allowing the solenoid to open and close the vent by rotating the vent axle. The vent also includes micro-switch 11 that provides an indication of whether the vent closure 4a is open or closed. Micro-switch 11 can be remotely
25 monitored so that the opening and closing of vent closure 4a can be tracked. Micro-switch 11 can also be used to operate a fan inside the cabinet.

As an equipment protection mechanism in the event of a power failure the solenoid may be arranged to operate the vent to open the vent so that the equipment inside the cabinet
30 does not over heat. In extreme cold environments the solenoid may be arranged to close the vent in the event of a power failure.

While vent 4 is shown as extending across housing 2 and being only a single vent more than one vent could be provided. The position and size of vent 4 may also be altered
35 without departing from the scope of the invention.

WHAT WE CLAIM IS:

1. An air circulation and ventilation unit including:
a housing configured to fit at least partially over the ceiling of an equipment
5 cabinet including fitting over at least one vent in the ceiling of the cabinet, so that the
interior of the housing is in communication with the interior of the cabinet,
the housing having a housing vent including a closure moveable between an
open position in which air is permitted to flow through the housing vent between the
outside of the housing and the inside of the housing and a closed position in which little
10 or no air is permitted to flow through the housing vent between the outside of the
housing and the inside of the housing, and
a controller to control the position of the housing vent closure.
2. An air circulation and ventilation unit as claimed in claim 1 further including a
15 temperature sensor attached to the controller that provides an indication of the
temperature inside the cabinet.
3. An air circulation and ventilation unit as claimed in claim 1 or claim 2 further
including a fan inside the housing to circulate air.
- 20 4. An air circulation and ventilation unit as claimed in claim 3 wherein the fan is
controlled by the controller.
5. An air circulation and ventilation unit as claimed in any one of claims 1 to 4
25 further including a heater inside the housing that is controlled by the controller.
6. An air circulation and ventilation unit as claimed in any one of claims 1 to 5
wherein the controller includes a solenoid that controls the position of the housing vent
closure.

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7. An air circulation and ventilation unit as claimed in any one of claims 1 to 7,
6 wherein the housing vent closure rotates between the open and closed positions.
8. An air circulation and ventilation unit as claimed in any one of claims 1 to 7
5 wherein the housing vent and closure are provided in an external wall of the housing.
9. The combination of an air circulation and ventilation unit as claimed in any one
of claims 1 to 8, and an equipment cabinet having a ceiling, with the housing fitting
over at least one vent in the ceiling of the cabinet, so that the interior of the housing is in
10 communication with the interior of the cabinet.
10. A combination as claimed in claim 9 further including a roof over the circulation
and ventilation unit.
- 15 11. A combination as claimed in claim 9 or 10 further including a fan inside the
cabinet to circulate air.
12. A combination as claimed in any one of claims 9 to 11 wherein the housing vent
is offset from the cabinet vent(s).

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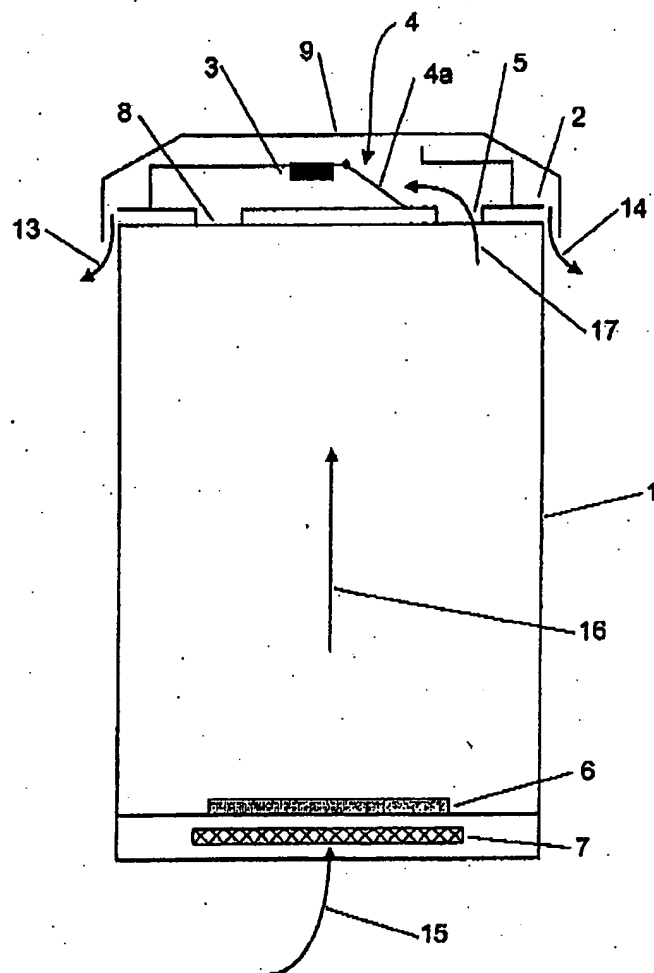


FIGURE 1

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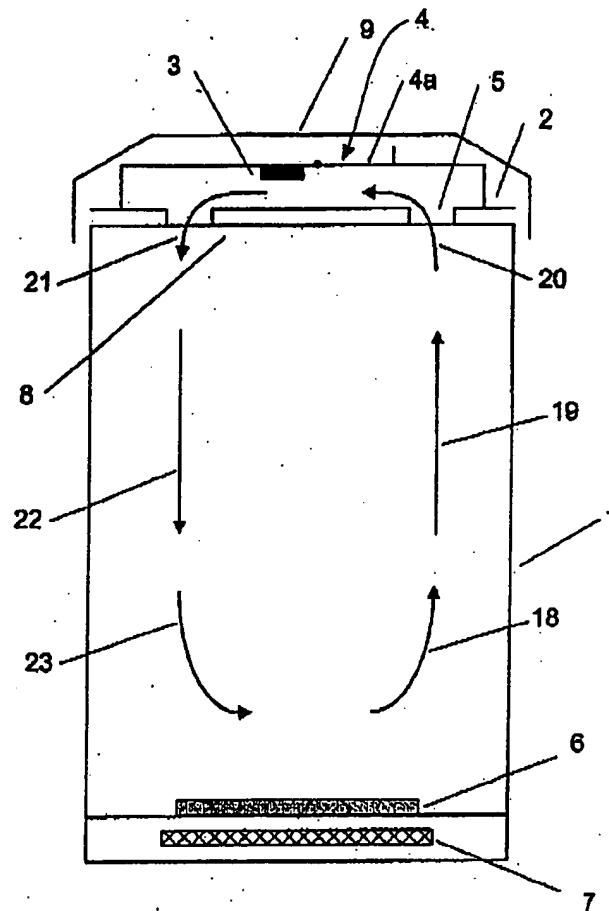


FIGURE 2

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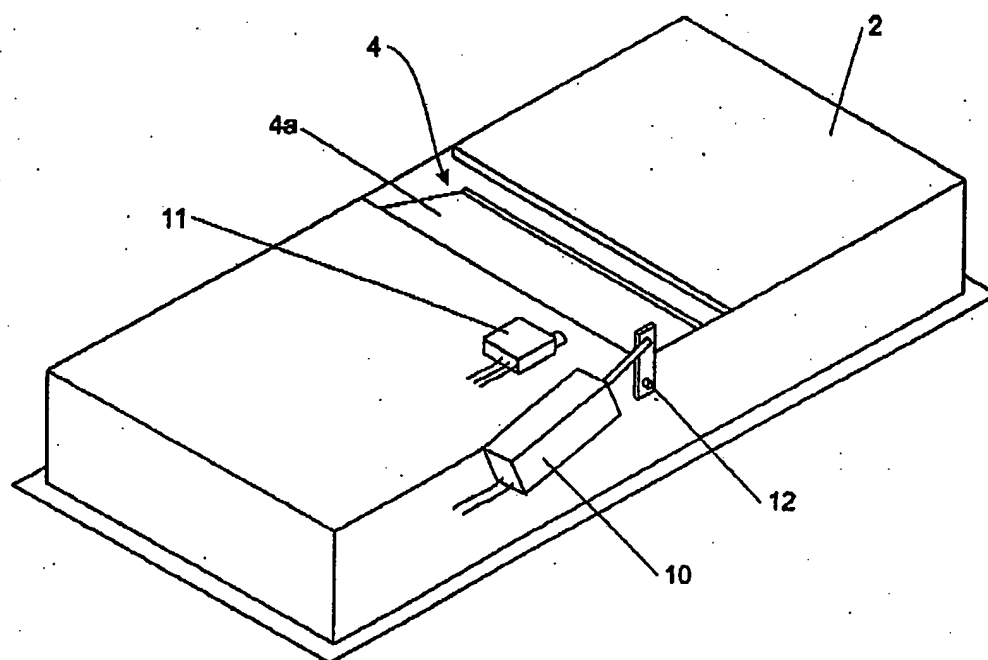


FIGURE 3